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## *ACADEMIC FREEDOM*[1]

MY subject is academic freedom, a difficult subject, not as yet very well understood in this country, but likely to be of increasing interest and importance throughout the coming century. I have divided my essay into three parts: the first dealing with academic freedom for teachers; the second with academic freedom for students; and the third with university administration as a type of free government in general.

### ACADEMIC FREEDOM FOR TEACHERS

In a democracy, and in the political and social organizations to which democracy takes kindly, there are some new difficulties in regard to academic freedom for teachers. The principal new difficulty is the pressure in a democracy of a concentrated multitudinous public opinion. The great majority of the people in a given community may hold passionately to some dogma in religion, some economic doctrine, or some political or social opinion or practise, and may resent strongly the expression by a public teacher of religious, economic, political, or social views unlike those held by the majority. In parts of our country at this moment liberty of thought and speech on certain topics is, to say the least, imperfect for men who do not coincide with the prevailing opinions and sentiments of the community in which they dwell. Even in colleges and universities in those parts a teacher holding unpopular opinions could,

[1] Address before the Cornell Phi Beta Kappa.

until very recently, hardly escape the alternative of silence or banishment. The teaching of history in schools and colleges is watched with great suspicion by different parties in church and state, lest some unwelcome lessons of present application be drawn from the history of the past. Professors of economics are not even supposed to be free in some American communities which have held for generations with great unanimity the doctrine of protection. The endowed institutions are by no means exempt from this strong pressure of public opinion; for they are sensitive to threats that the stream of gifts on which they depend will be cut off. This multitudinous tyrannical opinion is even more formidable to one who offends it than the despotic will of a single tyrant or small group of tyrants. It affects the imagination more, because it seems omnipresent, merciless, and irresponsible; and therefore resistance to it requires a rare kind of moral courage. For this difficulty there is no remedy except the liberalizing of the common people, or at least of the educated class. To be sure, there is another mode of preventing free teaching on dangerous subjects, which is quite as effective as persecution and much quieter, namely, the omission of all teaching on those subjects, and the elimination of reading matter bearing on them. Thus the supreme subject of theology has been banished from the state universities, and from many of the endowed universities; and in some parts of the country the suppression of Bible-reading and prayer at the opening exercises of the schools, in deference to Roman Catholic objections, has resulted in the children's getting no direct ethical instruction whatsoever. A comical illustration of this control by omission is the recent suggestion that Shakespeare's "Merchant of Venice" ought not to be read in any school where there are Jewish children, because it contains an unamiable and inaccurate representation of the character of a Jewish money lender.

A long tenure of office for teachers is wellnigh indispensable, if a just academic freedom is to be secured for them. In the absence of laws providing for it, this long tenure, after suitable periods of probation, is only to be secured in this country through the voluntary, habitual action of school committees and boards of trustees. In this respect, great improvements have been made all over the country through the reforms in the structure or composition of the committees which govern the free schools and of the boards of trustees for institutions of higher education; but much still remains to be done. So long as school committees insist on annual elections of all teachers, and boards of trustees of colleges and universities claim the right to dismiss at pleasure all the officers of the institutions in their charge, there will be no security for the teachers' proper freedom. We have, however, learned what the proper tenure for a teacher is. Teachers in every grade of public instruction from the lowest to the highest, when once their capacity and character have been demonstrated, should hold their offices without express limitation of time, and should be subject to removal only for inadequate performance of duty or for misconduct publicly proved. To procure this tenure for teachers, wherever it does not now obtain, should be the special care of all persons who believe that education is the prime interest of the commonwealth, and that teachers should enjoy perfect liberty within the limits of courtesy and of a "decent respect for the opinions of mankind."

In the institutions of higher education the board of trustees is the body on whose discretion, good feeling, and experience the securing of academic freedom now depends.

There are boards which leave nothing to be desired in these respects; but there are also numerous boards that have everything to learn with regard to academic freedom. These barbarous boards exercise an arbitrary power of dismissal. They exclude from the teachings of the university unpopular or dangerous subjects. In some states they even treat professors' positions as common political spoils; and all too frequently, both in state and endowed institutions, they fail to treat the members of the teaching staff with that high consideration to which their functions entitle them. In the newer parts of our country, it has of course been impossible to find at short notice men really prepared to discharge the difficult duties of educational trusteeship; and it will take generations yet to bring these communities in this respect up to the level of the older states and cities which have had for generations abundant excellent material for such boards of trustees.

In the institutions of higher education there is usually found an organized body of the permanent teachers called a faculty. This body exercises customary powers delegated to it by the board of trustees; and its determinations are ordinarily made by a majority vote after more or less discussion. It deals with questions of general policy affecting both teachers and students, and its votes may sometimes limit the freedom of its own members. Such restrictions, however, as proceed from a faculty are not likely to be really oppressive on individuals; for every voter in a faculty is likely to remember that he himself may hereafter be unpleasantly affected by the same kind of majority vote which he is thinking of taking part in against a resisting colleague.

As a rule, the faculty of a college, professional school, or university is the real source of educational policy and progress,—so much so, that the vitality of any institution may best be measured by the activity and esprit de corps of its faculty. Is the faculty alert, progressive, and public-spirited, the institution will be active and increasingly serviceable; is the faculty sluggish, uninterested, and without cohesion, the institution will probably be dull or even retrograde. If a faculty chooses, it can really limit academic freedom; but it is not likely to do so, because its members will not deny to others the freedom they desire for themselves, unless, indeed, on rare occasions, and for short periods. A faculty is much more likely to limit unduly the academic freedom of students than of teachers; and yet, even in this field, it is harder and harder for a lively and enterprising faculty, representing any adequate variety of university subjects, to restrict the just freedom of students.

Interference with the academic freedom of an individual professor is in these days more likely to come from his colleagues in the same department than from the faculty as a whole. Of course in those institutions which maintain only a single teacher for each subject, there is no competition among teachers of the same subject, and no departmental organization which may become formidable to the individual teacher; but many of our colleges and universities have now got beyond that elementary stage, and have considerable groups of teachers working on one subject, as, for instance, the classics, the modern languages, the mathematics, history, government, economics, philosophy, the physical sciences and the biological sciences. These groups of teachers, whatever called—divisions, departments, or schools—have lately acquired in some American universities very real powers, and among these powers is partial control over the teaching of the individual teachers within each group. The senior

professor of the group sometimes has a formidable amount of restrictive power. This danger to liberty is diminished in some institutions by disregarding seniority in selecting the chairmen of departments or divisions, and making frequent changes of chairmen in those departments which have many members. The points at which danger to freedom exists are: first, the assignment of subjects to the younger members of the department; secondly, the direct access of advanced students to all members of the department; and thirdly, the exchange of subjects year by year among the various members, old and young. At any one of these points it is easy for a department to become despotic, particularly if there be one dominant personage in it. The exercise of power by a division, department, or school should therefore be carefully watched by the president, the dean of the faculty, or some committee of the faculty; so that the just liberty of all members of the department may not be invaded.

The prodigious stream of benefactions to institutions of education in the United States, which has now been flowing in increasing volume ever since the Civil War, has brought upon the endowed institutions a new risk in regard to academic freedom. So far as state institutions are also in a measure endowed, as is the case with the University of California, the same new risk is incurred by them. The risk is all the greater because the living benefactor plays in these days a part even more important than that of the dead benefactor. Ought the opinions and wishes of a living benefactor to influence the teaching in the institution which he endows? In general, the answer must be in the negative; because teaching which is not believed to be free is well-nigh worthless. It inevitably loses its intended effect on those who listen to it. It has no effect even on those who agree with, or are pleased with, its general tenor. Nevertheless, benefactors have certain rights in this respect. They may fairly claim that their benefactions entitle their opinions and sentiments to be treated with consideration and respect, and not with contumely or scorn, in the institutions they have endowed, or by the professors whom their gifts support. If their benefactions are for general uses and not for the support of any specific courses of instruction, they may fairly claim that subjects likely to be taught in a manner repulsive to them should be omitted altogether, unless some serious public obligation requires the institution to include them. The mere lapse of time will probably free an endowed institution from embarrassments of this nature, not chiefly because the living benefactor will die, but because the burning questions change so frequently with the rapid progress of society. Thus, the choice between Calvinism and Channingism was a burning question seventy years ago, but now few people take keen interest in it. In like manner, a few years ago academic freedom was seriously impaired during the discussion about the relations of gold and silver to a stable currency; but now all heat has gone out of that controversy. For two generations protection and free trade have been hot subjects; but in a few years they will be stone cold, because the practise miscalled protection will have become inapplicable to American industrial conditions, and, indeed, manifestly injurious to both manufactures and commerce. Any slight interference with academic freedom which time will certainly cure may be endured with equanimity for a season, in consideration of great counter-balancing advantages.

There is another university authority who can, if he choose, put limits to academic freedom for a time—the president.

The president of moderately long service has probably been concerned with the selection and actual appointment of a large majority of the teaching staff in his institution. He has also probably had to do with the step-by-step promotion of nearly everybody connected with the institution. For these reasons his wishes may have undue weight with the individual professor who desires to make changes in his subjects or methods of instruction. Some presidents are, therefore, careful how they bring any restrictive pressure to bear on teachers; but others are careless in this respect, or deliberately attempt to control the nature or quality of the instruction given by individual teachers, particularly in what they regard as critical or dangerous subjects. In American institutions few presidents possess dangerous constitutional or charter powers in this respect, and none should exercise such powers. A president may of course remonstrate with a professor who seems to him to be exceeding the just limits of academic freedom, and he may properly give distinct advice when consulted beforehand by any member of his staff on a question relating to academic freedom; but he should never attempt to impose his judgment or his will on a teacher.

The real liberty of a teacher to teach as he wishes to may be closely limited by the customs or habitual usages of the institution with which he is connected, even more than by the direct action of the constituted authorities. Every earnest and progressive teacher desires to be freed, as much as possible, from routine details which admit of little variety, and have ceased to be instructive or otherwise beneficial to himself. If his habitual duties involve much work of this character, his own rate of progress in knowledge and efficiency will be checked, and his enthusiasm may be chilled as the years go on. Routine is an enemy to progress, and to real mental liberty. Again, in every teacher's life there is apt to be a large element of year-by-year repetition. Year after year he reads the same authors with his classes, or he deals with the same subjects in his laboratory teaching, and even with the same materials for illustrating his subjects. He may be held to an unreasonable degree of repetition by the faculty, by his department, or by two or three colleagues who refuse to exchange with him. As years go on, it is easier for him to follow a routine, or to use again his manuscript notes grown yellow and brittle with age, than to change his habits, or to venture into comparatively new fields. Routine and repetition have done their work. They have limited his freedom, and therefore his growth. In all teaching, at whatever grades, there must be elements of routine and repetition, but excess of these indispensable elements is to be guarded against in every possible way, both by the teacher himself and by the authorities to whom he is responsible; for the teacher's efficiency depends primarily on the maintenance of his vitality and enthusiasm.

The prudent teacher in school, college, or university will keep a sharp lookout on two other risks to which American teachers are exposed; they will beware of doing too much teaching and of undertaking too much administrative work. The teacher for life absolutely needs to reserve time and strength for continuous acquisition and development on his own part. He must not be always giving out information and influence. He must have time to absorb, to feed his own growing powers, and to rekindle his own enthusiasms at the great lamps of literature and science. The university teacher ought to keep time and strength to contribute a little to the advancement of his own subject. This he can

not do if teaching or administration, or both, take up all his time or all his energy. He should therefore aim at regulating his academic life in such a way that these higher purposes may be fulfilled; and this good end in each individual case should be furthered by every academic authority and influence. These are some of the subtler elements in a well-composed academic freedom.

Professors and other teachers, who should be always teaching or making researches, need to be relatively free from pecuniary cares; so that their minds may run on their work. To this end they should have fixed salaries, and retiring allowances; so that they may adjust their scale of living to their earnings, and not have to think about making money, or to feel anxiety about disability or old age. This detachment from ordinary pecuniary or livelihood anxieties is an important element in their mental freedom, and for the right kind of person a strong inducement to the profession. The teacher ought always to be a person disposed to idealism and altruism; and he should have abandoned once for all the thought of measuring his success by the size of his income.

In the best managed universities, colleges, and school systems a teacher is always free to accept promotion in another institution or school system, although in most cases he may properly consider himself bound to finish, where he is, an academic year begun. It is inconvenient for the institution which the promoted teacher leaves to lose him; but in the long run institutions which are liberal and cordial in such dealings will have a better staff than they would have if they tried to hold their successful teachers to long contracts against the will and to the disadvantage of those teachers. This feature of academic freedom has far-reaching good effects on the profession and the nation, as appears conspicuously in the educational history of Germany, and the present condition of the leading educational institutions in the United States.

Finally, academic freedom for teachers is properly subject to certain limitations which may best be described as those of courtesy and honor. They resemble the limitations which the manners of a gentleman or a lady impose on personal freedom in social intercourse. The teacher in a school, or the professor in a college or university, may properly abstain from saying or doing many things which he would be free to say or do if it were not for his official position. He may properly feel that his words and acts must inevitably have an effect on the reputation and influence of the institution with which he is connected. This sentiment undoubtedly qualifies or limits the freedom he would otherwise exercise and enjoy. Many a professor in this country has felt acutely that he was not entirely free to publish in journals or books just what he thought on controversial subjects, if he put in connection with his signature his official title as professor. Doubtless some difficult cases of this sort arise in which the reputation of an institution is unfavorably affected temporarily by the publications, or public speeches of one or more of its officers; but no satisfactory defense against this kind of injury has yet been invented, since the suppression of such publications does infinitely more harm to the general cause of education than it can do good to the institution concerned. Most learned societies declare in some conspicuous place within their customary publications that the society is in no way responsible for the opinions or conclusions of the individual contributors; but it is hardly practicable, even if it were desirable, for a university, college, theological seminary

or school of technology to put a like declaration on all the publications made by their officers. The only satisfactory defense of the institutions against the risks under consideration is to be found in the considerateness and courtesy of the teachers concerned, and in their sense of obligation to the institutions with which they are connected, and of the added weight which their official position gives to their personal opinions.

When I was first president of Harvard College I got a lesson on this subject from one of the most respected of the Harvard professors of that day. He had recently made to the American Academy of Arts and Sciences a communication which dealt in a novel way with one particular aspect of the financial credit of the United States; and this communication had been warmly attacked by several of his fellows in the Academy, including some influential Boston business men. He was in the act, however, of issuing a manual for schools and colleges, in which he had incorporated the questionable doctrine, and on the title page of this book he had put under his name his professorial title in Harvard University. As the time approached for publishing the volume—the plates of which he owned—his mind misgave him with regard to the propriety of proclaiming this unusual and controverted doctrine in his capacity as professor in Harvard University, and he therefore asked me, as President, what the president and fellows of Harvard College would think on that point. I was obliged to tell him that the president and fellows would prefer to have that doctrine omitted from the book, unless, indeed, he were willing to omit from the title page his own official title as a Harvard professor. The result was that the troublesome chapter was omitted; but the professor lost all interest in his entire manual, and insisted on selling the plates to his publisher, and foregoing his royalty on the sales of the book. The incident taught me that the best defense of an institution against abuses of academic freedom was to be found in the sense of duty and honor which obtains among its officers.

### FREEDOM FOR STUDENTS

The college student coming from a good secondary school has probably had some small amount of choice among the subjects provided at his school towards admission to college. He may arrive at his college with more Latin and Greek and less modern languages, or the reverse. He may offer himself in several sciences or in not more than one. His choice in this respect may have been closely limited, and yet not without serious effects on his subsequent career. When he reaches his college, normally at eighteen or nineteen years of age, he ought to find at once a great enlargement of his freedom of choice among studies. This is for the student the first element in a just academic freedom. By close attention to his own individual problem, and to his own antecedents, and with a little assistance from an expert in the list of courses and the schedule of hours, he will have no difficulty in finding the courses most suitable for himself. In the freest elective system there are plain fences marking out the feasible tracks. These fences are in most cases the natural and inevitable sequences of the courses offered in the several subjects of instruction. A few may be arbitrary and artificial, such restrictions being probably the results of inadequate resources in the college itself, or of some policy inconsistent with its general regime of liberty. The choice of studies made in any individual case may be very wisely modified, or fundamentally changed, by the student's choice of teachers. This choice among teachers is a very valuable element in academic freedom for the stu-

dent. The newcomer at a college may not possess the information needed to enable him to exercise this freedom; but during the first half-year or quarter of residence most students can acquire sufficient information about the different teachers of the subjects which interest them to enable them to exercise discreetly this freedom of choice among teachers. Having found his best teacher, the student ought to find himself free to follow him for several years. Unfortunately faculties are more likely to interfere with this particular liberty than with any other, as for instance by enacting that philosophy, or economics, or political science shall not be accessible to any student before the sophomore year.

Under a broad elective system in the arts and sciences the students will always make many choices of single courses which interest them, or look to them profitable; but there will also be a great variety of voluntary groupings of courses, and the liberty to make an appropriate grouping is a very important part of academic freedom for the student. Such groupings are often determined by the student's foreknowledge of his professional career, or if this knowledge is lacking, by his own selection of kindred subjects, all of which commend themselves to his taste or his judgment. This liberty to make groupings, each one for himself, is another important element in a just academic freedom. Almost all students who decide on their profession early in their college course make groupings which will further them in their professional career, and in their preparation therefor, and for the student there is no safer principle of selection among appropriate college subjects. A student who lacks this clear guidance may most safely depend for guidance in the choice of his studies on the tastes and capacities of which he is conscious. Among the multitude of culture courses which a large college offers, the safest selection for the individual student is that of courses in which he has the capacity to achieve something considerable. Interest in a subject is an indication of fitness for its study, or, in other words, a student is much more likely to succeed in a subject which interests him strongly than in a subject which does not. Achievement and gain in power are the true rewards of persistent exertion, and the best spurs to further effort. The college student ought to be free to specialize early in his course, or not to specialize at all; to make his education turn on languages, mathematics, history, science or philosophy—for example—or on any mixture of these great subjects.

The college student may reasonably expect to find himself free from attempts to impose opinions on him. These attempts may be made by his teachers, or by intimate comrades, or by groups of companions and friends, or by mass meetings. He has a right in these days to be free from the imposition of opinions, whether attempted by elders or associates, by one individual or a multitude. He has also a right to be free from all inducements to cant, hypocrisy, or conformity. On this account, voluntary attendance at all religious exercises is a valuable element in academic freedom. No student ought to be able to suppose that he will gain anything towards high rank as a scholar, or social standing, or popularity among his fellows by any religious observance or affiliation whatsoever. A mercenary or profit-seeking spirit in religious practices is very injurious to young people, and is peculiarly repulsive in them.

The student who needs pecuniary aid in college, or desires employment in which he can partly earn his livelihood, ought to find an absolutely free competition for such assistance on merit only, without regard to any opinions or practices of his. It is

highly desirable that college students should be free from care for their livelihood during the whole period of education, accepting support from their parents or other loving friends. To give this support is the precious privilege of parents, to accept it the precious privilege of children. Nevertheless, it is one of the best results of democracy that young men of capacity and character find it possible to obtain a prolonged education for the professions or for business, although they are obliged to support themselves wholly or in part during the long period of strenuous study. Endowments, the bounty of the state, or the facilities for obtaining appropriate employment which colleges now provide, procure this freedom for thousands of young Americans every year. The young men thus aided to attain a larger and freer career should invariably feel bound in after life to pass on and amplify the privilege they enjoyed.

Finally, the student ought to find himself free to determine the method of his daily life with no more restrictions than the habits and customs of civilized society necessarily impose. His problem will be to regulate his own life wisely by self-control in liberty. Up to his entrance to college his mode of life has probably been regulated for him by home rules, or school rules; and he has been almost constantly under the observation of parents or teachers, or both. Now, at college, he should be free. He will probably make some mistakes, at first, about eating and drinking, sleeping, taking exercise, arranging his hours for work and for play, and using his time; but his mistakes will not be fatal or beyond remedy, and he will form habits based on his own observation and experience and his own volitions. These are the habits that prove trustworthy in adult life. As in the outer world, so in the comparatively sheltered college world, freedom is dangerous for the infirm of purpose and destructive for the vicious; but it is the only atmosphere in which the well-disposed and resolute can develop their strength. Under any college regime, whether liberal or authoritative, a very valuable though dangerous part of the student's freedom is his freedom to choose his comrades, or habitual associates. That choice will show in every individual case whether the young man possesses moral principle and firmness of character or not. If the choice is good, he will be safe in liberty; if the choice is bad, he will be unsafe under any regime. The student ought to choose his own comrades deliberately, and after some study of the accessible variety of associates. To be forced to accept an unknown group of permanent associates within three weeks of entering college is an unfortunate limitation of academic freedom.

I have thus far spoken as if academic freedom were one thing for teachers and another thing for students; and, indeed, the aspects and results of that freedom for the mature men whose life work is study and teaching, and for the youth who are only beginners in the intellectual life, are somewhat different. Nevertheless, in a college or university there is a perfect solidarity of interests between teachers and taught in respect to freedom. A teacher who is not supposed to be free never commands the respect or personal loyalty of competent students, and students who are driven to a teacher are never welcome, and can neither impart nor imbibe enthusiasm.

The real success of a college or university teacher in the long run depends on his training up a few sincere and devoted disciples. To this process, freedom on both sides is essential. The student must be free to choose the same teacher for several years, and the teacher to hold the same student. There must be a voluntary cooperation of tastes, capacities, and wills for

years. As a rule, enduring influence is won only by a teacher who thus brings up a few congenial, cooperative disciples capable of carrying on and developing their master's work. The duration of the master's influence depends on the capacity of his disciples to go beyond him, and develop his ideas under new conditions; and for this development they in their turn will need a genuine freedom for themselves, and for their students. Such is the rapid progress of science, letters and art in these days that the old ideas can only live as they are transmuted into the new; but for the just development of the new out of the old freedom is indispensable. All truth-seeking needs freedom, and in a university teachers and taught ought to be constantly seeking truth together. Even partial truth makes free, and every sincere searcher for the next glimpse of truth beyond the present limits of knowledge needs not only a perfect candor in his own soul, but freedom from all artificial external restraints on the flights of his intelligence and goodwill.

### UNIVERSITY GOVERNMENT IS A TYPE

The government of a good college or university in the United States, which is free from denominational or political control, foretells the type of the best ultimate forms of human government. It is a government in which there is no use of force. There is some police inspection, and a constant watchfulness against disease, fire, noise, and similar evils, but no prison, no physical punishment, the least possible interference with the personal conduct of the governed, and a generous amount of goodwill between all members of the community. The citizens, or constituency, of this government are selected persons as regards intelligence, goodwill, and cooperative purpose. Exile from the community is the sole penalty for misconduct, inefficiency, or unworthiness. The government is not arbitrary, and yet it possesses large elements of discretion. It habitually acts under rules and usages, yet it is progressive; it does not permit a perverse individual to injure the main body, but its dealings with the individual are always in the direction of reformation, education, and recovery from downfall, and exile is never resorted to until many efforts at recovery and reformation have failed. Vengeance on the sinner, and the satisfaction of justice by punishment, are absolutely excluded from its discipline, as in the first place unworthy of any intelligent ruler or governor, and also as completely ineffective towards either individual or community improvement. There are no elective bodies analogous to Senate and House of Representatives, and yet there are legislative bodies and an executive. Long tenure, and life office play a great part in university organization, and as a rule there is no jealousy or distrust of long service executives, provided they are considerate and fair. On the contrary, in universities the governed generally exhibit a decided preference for an experienced executive of proved capacity, and a dislike for changes in executive departments.

The principle of authority is very little applied in good university government. Respect is paid to age, if it remains vital, and to experience, especially to intensive experience; but mere seniority counts for very little, and an administrator's influence is supported chiefly on his persuasiveness, or power of discerning a good reason for a proposed action, and then stating it convincingly.

In the government of the American universities, sentiments have a large place, as indeed they should have in all government. Among these sentiments are a strong love for the site and surroundings of the university—an affectionate memory of the

fields and hills, the streams or lakes within sight of which years of rapid intellectual and spiritual growth were passed; downright affection for teachers who greatly stimulated the intellectual life of their students; and among the members of the university staff itself, admiration and affection for certain colleagues whose traits of character, wit, or charming personal idiosyncrasies especially commend them to their brethren. Occasionally a college administrator who is also a preacher from pulpit or platform wins for the time being an extraordinary influence over large numbers of young men by the purity and force of his character, and the high spirit of his instruction and exhortation. These sentiments, like all the higher loves, grow up in a freedom which knows no admixture of fear, compulsion, or domination. They are all noble, refined, and inspiring sentiments. To develop them in the highest degree is one of the chief objects of academic freedom.

A university should be entirely free from the highly restrictive bonds described in the words, caste, class, race, sect, and party. In its best form it already is so. These formidable restrictions on individual liberty should play no part in its organization or its discipline. The world has had quite enough of these ancient means of dividing mankind into antagonistic sections. Every university should exert a strong unifying influence in these respects.

I have said that the university form of government is a prophecy. It really foretells the ultimate form of all good government among men—a government based on cooperative intelligence, almost universal goodwill, and noble loves. Its leaders are of a new sort which deserves study.

A modern university, being a voluntary cooperative association of highly individualistic persons for teaching and for advancing knowledge, is thoroughly democratic in spirit, and everywhere its objects are to train productive mental power in the young, to store each power in a select group from the next older generation, and to apply this stored power to the advancement of knowledge. This peculiar kind of democratic association needs leaders or managers; but the work of a university is so different from ordinary governmental and industrial work, that we are not surprised to find that the university leader or manager is a different kind of a leader from that common in governments and industries. It is an interesting question, therefore, what sort of leadership a university needs; what contribution to academic freedom the right sort of university leader makes; and what sort of freedom he needs for himself.

University administration is usually, and in chief part, administration by a selected expert who has had opportunity to prove his capacity. He ought also to be an advanced student in some field of knowledge —historical, economic, linguistic, scientific or artistic, it matters not which—and a student who has learned by experience what research or scholarly productiveness is and implies. Like the captain of industry, or the political ruler, he must have skill, capacity, and knowledge; must be inventive and constructive in his thinking; and must welcome care and responsibility. His inducements to laborious and responsible service are, however, different from those which are effective with other sorts of leader. A high salary, or the prospect of luxury for himself and his family, will not tempt him. These inducements will not draw the right kind of man into university administration any more than into teaching or research. He cannot be induced to do his best work by offering him any money prize, and he will manifest no desire whatever for arbitrary power over masses of human beings, or for what is ordinarily

called fame or glory. The effective inducements will be the prospect of eminent usefulness, public consideration, the provision of all real facilities for his work, enough relief from pecuniary cares to leave his mind free for invention and forelooking, long tenure, and income enough to secure healthy recreations. He will not wish to receive a salary so high as to distinguish him widely from his colleagues the professors, except so far as the proper discharge of his functions involves him in expenditures from which they are exempt. He will want to work with a group of associates whose pecuniary recompense and prospects are not very unlike his own.

This educational expert will set a high value on freedom for himself. He will hope that trustees, faculties, alumni, and the supporting public, will permit him to carry out his own plans and provisions, or those which he espouses. He will hope that the responsibility he carries will entitle him to a certain deference for his judgments from his colleagues and the academic bodies. In short, a just academic freedom for the head of a university is more important than for any other person or group of persons connected with the university, for the reason that in education, as in every other function of democratic government, and every branch of the national industries, the problem how to create and develop real leadership is the most serious problem which confronts democratic society.

In all fields, democracy needs to develop leaders of high inventive capacity, strong initiative, and genius for cooperative government, who will put forth their utmost powers, not for pecuniary reward, or for the love of domination, but for the joy of achievement and the continuous, mounting satisfaction of rendering good service. This is just the kind of leader that democracy ought to produce for highly organized industries and for public service. The military commander is necessarily an autocrat; the hereditary ruler may be either a despot or a figurehead. The present type of industrial captain is too often governed by motives, and pursues ends, which are neither altruistic nor idealistic. None of these types is good for the democratic leader of the future, whether he is to serve in some great industry, in government, or in a university. At this moment the university administrator makes the best use now made of the powers of individualism on one hand, and of collectivism on the other, and understands better than any other leader in the world that in order to have successful cooperative action on the part of thousands of human beings, special emphasis must be laid on brotherhood in that admirable trinity—freedom, equality and brotherhood.

The American university gives an effective demonstration of the good results of the voluntary association in common work of many independent and unlike individuals possessing the maximum of goodwill; and academic freedom is, therefore, a good type of the considerate, humane freedom which will ultimately become universal.

Charles W. Eliot
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## *SCIENTIFIC BOOKS*

### Recent Literature on Echinoderms

There has been a marked increase in the attention given to the echinoderms, since the opening of the twentieth century, and during the last year especially, the contributions to our knowledge of the group have been numerous. Among these there are three which, for widely different reasons, particularly deserve attention.

Fisher's "Starfishes of the Hawaiian Islands"[1] is the first extended contribution

[1] "The Starfishes of the Hawaiian Islands," by Walter K. Fisher, acting instructor in zoology, Leland Stanford Junior University. Extracted

from a newcomer in the field, but it is easily the most important publication on starfishes which has appeared in America, at least since Alexander Agassiz's "North American Starfishes." Although Dr. Fisher is chiefly concerned with a systematic account of the Hawaiian Asteroidea, particularly those collected by the *Albatross* in 1902, many important morphological points are discussed and the geographical distribution of the species is given careful consideration. The introduction states that the *Albatross* collection consists of about 1,650 specimens, representing 60 species, of which the author considers 52 are new to science. This surprisingly large percentage of novelties is not so remarkable, however, when the situation of the Hawaiian group is considered, and it is remembered that, previous to this report, only eleven species (and at least two of these erroneously) were recorded from the islands. The classification used is a compromise between the two fundamentally different systems of Perrier and Sladen, with due reference to the work of Verrill, but unfortunately Fisher does not explain what principles have governed him in his choices, and we are left in the dark as to what characters he considers of the greatest importance in determining relationships. He apparently gives considerable weight to the absence, or presence and form, of paxillæ, superambulacral plates and pedicellariæ, all of which, while of value in classification, reveal notable diversities in nearly related forms. On the whole, however, there can be little question that Fisher has shown excellent judgment and his classification is probably as satisfactory as can be devised in the present state of our knowledge. The nomenclature used is admirable, for, following the sensible lead of Bell and Verrill, adherence is given to the International Code, and the pre-Linnæan names, resurrected or maintained by Sladen in his great *Challenger* monograph, are rejected. While this course results in the alteration of some familiar names (such as the change of *Cribrella* to *Henricia* and *Palmipes* to *Anseropoda*), there can be no doubt that it is a long step towards a stable nomenclature for starfishes. Following the introduction, ten pages are given to a synopsis of the Hawaiian Asteroid fauna and a discussion of its relationships. The most interesting points here brought out are that, although starfishes were taken at 126 stations, the *Albatross* collection consists almost entirely of sublittoral and continental forms, only three or four species having been taken in less than 20 fathoms and fewer than ten in more than 500 fathoms; that only one species previously recorded from the islands was taken; that the Hawaiian starfishes are distinctly Indo-Pacific in their relationships rather than American, notwithstanding that the ocean currents passing the islands are west-bound; that these west-bound currents have only brought five species of starfish to the islands; and that seven or eight Hawaiian species find their nearest relatives in the Atlantic Ocean or Caribbean Sea. The following 116 pages are taken up with the account of the Hawaiian starfish fauna, and open with an artificial key to the nineteen families recognized as occurring in the area under consideration. This key is clear and well arranged, and while obviously artificial in a few particulars (as such keys are of necessity bound to be), it will doubtless prove more useful than any similar key hitherto published. It is probable, however, that further investigation will reduce the number of families recognized by Fisher, for they are certainly of very unequal value as at present arranged. Such families as Mithrodiidæ and Heliasteridæ are certainly much less satisfactory than Astropectinidæ and Linckiidæ. Following the key, the families are taken up in their natural sequence, the synonymy being followed by an artificial key to the genera, and each genus, when containing more than a single form, is introduced by a key to the species. These keys are admirable in matter and form and make up in a measure for the absence of any diagnoses of families and genera (except those which are new). The descriptions of the new genera and species, and the remarks on

from U. S. Fish Commission Bulletin for 1903, Part III., pp. 987–1130, pls. I.–XLIX. Issued June 30, 1906. Washington: Government Printing Office, 1906.

previously known forms, and on nomenclature, leave nothing to be desired. The volume ends with two pages of glossary, two of bibliography, eight of explanation of plates, forty-nine plates, and a good index of three pages. The plates are of more than usual excellence, thirty-six being photographs (many enlarged), light figures on a black background, while the remainder are drawings of morphological details, chiefly by Dr. Fisher himself. The Bureau of Fisheries and Dr. Fisher are both to be congratulated on the appearance and the contents of this report, which will rank hereafter, in importance to students of the Asteroidea, with the classic works of Perrier and Sladen.

The report of the Echini of the *Valdivia* collections[2] is a great contribution to the taxonomy of the Echinoidea, from one of the most eminent of living Echinologists, and is the most elaborate work which he has yet produced. Among other reasons, it is notable for the attempt made to show details of structure, particularly the pedicellariæ, by means of microphotography. It is a quarto volume of 228 (63–290) pages, dealing with nearly one hundred different Echini, of which 71 were collected by the *Valdivia* at 62 stations. Of these, 23 were new to science at the time they were taken, but only three or four are described here for the first time, as preliminary reports on the collection were published in the *Zoologischer Anzeiger* in 1901 and 1905. Döderlein's work is, however, far more than a mere systematic account of the Echini of the *Valdivia,* for the first part of the volume consists of a discussion of the new system and principles of classification proposed by Mortensen, in which the pedicellariæ play such an important part. After a brief introduction and some remarks in regard to his methods of illustration, Döderlein proceeds to a short review of the recent works of Mortensen, de Meijere and A. Agassiz, following this with a dozen pages of discussion of the pedicellariæ and their value for purposes of classification, in which the writer reveals his sympathy with Mortensen's methods, although not oblivious to the difficulties which they involve. Several pages are given to remarks on the interrelationships of the different groups of Echini, and then comes an outline of the classification of the recent Echinoidea, as Döderlein would have it. This classification leaves out of account the evidence of paleontology and lays particular stress on the pedicellariæ. It divides the Echinoidea into two subclasses, *Cidariformia,* with the single family Cidaridæ, and *Diadematiformia,* with two orders, Regularia and Irregularia. The Regularia includes two suborders with a single family each and two with five families each. The Irregularia consists of two suborders, Clypeastroidea with four families and Spatangoidea with six families. It is hardly probable that this classification will be widely accepted, for it is difficult to believe that the Spatangoids are more nearly related to the Diadematidæ and Echinothuridæ, than are the Cidaroids, and surely the mere position of the anal opening is not of greater morphological significance than the presence or absence of the complicated "Aristotle's lantern," as the position assigned the Clypeastroids forces one to believe Döderlein assumes. Following the outline of the proposed classification, 183 pages are given to a discussion of the seventeen families represented in the *Valdivia* collection, with full descriptions, models of their kind, of all new species, important accounts of many little-known forms, and elaborate descriptions of the pedicellariæ of all species, not yet so treated by Mortensen. Special attention is given the Cidaridæ the genera proposed by Mortensen are discussed in detail and a new grouping of the species into ten genera, with five subgenera, is suggested. This is the least satisfactory section of the report, owing to needless and confusing changes in long-established names and to a curious lack of consistency, due apparently to

[2] "Die Echinoiden der deutschen Tiefsee-Expedition." Von Dr. Ludwig Döderlein. Mit 42 Tafeln und 46 Abbildungen im Text. Abdruck aus Wissenschaftliche Ergebnisse der deutschen Tiefsee-Expedition auf dem Dampfer *Valdivia*, 1898–1899. Im Auftrage des Reichsamtes des Innern herausgegeben von Carl Chun, Professor der Zoologie in Leipzig, Leiter der Expedition. Fünfter Band. Verlag von Gustav Fisher in Jena, 1906.

the "personal equation" in the attempt to apply Mortensen's pedicellarian principles. It seems to the present reviewer that distinctions between genera are impracticably fine when degrees of difference in a single microscopical character are their only basis. Döderlein's argument is badly hampered by the fact that his own figures contradict his words. Thus it is said several times in the text that the globiferous pedicellariæ of *Stereocidaris* lack an unpaired end-tooth, but not less than a dozen of the figures given on plates XXXVI. and XXXVII., illustrating the pedicellariæ of Stereocidaris, show such an end-tooth and in some cases it is very conspicuous. The volume closes with a brief review of the geographical distribution of the *Valdivia* Echini; a list of the stations at which Echini were collected, with location, depth, bottom temperature, species taken and number of specimens of each; a bibliography; a register of genera and species, arranged alphabetically (virtually an index); and a table of contents. The list of stations shows that the most interesting hauls were at Station 103, off South Africa, in 277 fathoms, where nine species were taken, and at Station 199 in "Nias-Sudkanal," in 261 fathoms, where six species occurred. Special reference should be made to the illustrations in this report, which are very numerous, but of very unequal merit. All are photographic in origin, save only a few outlines of pedicellariæ. Excepting these few outlines, the text-figures are mostly mere "shadow-pictures," and while some are useful, the great majority are of little value. Of the plates, two (IX. and XI.) are heliotypes and are very good, while the remainder are phototypes on cream-tinted paper and are often very poor. The trouble in many cases is obviously due to the object having been out of focus when photographed, and some important figures are ruined by this inexcusable blunder. Where bare tests are shown, they were seldom carefully cleaned, and the figures are correspondingly unsatisfactory. The numerous microphotographs of pedicellariæ are useful and many are excellent, but a large proportion are aggravatingly indistinct on important points. On the whole, it must be admitted that this report, because of the undue importance given the pedicellariæ for systematic purposes and the many unsatisfactory figures, is somewhat of a disappointment, and does not compare favorably with the previous work of its eminent author.

The first volume of the "Cambridge Natural History"[3] contains six chapters devoted to the Echinoderms, the work of the well-known embryologist, E. W. MacBride. After a brief introduction, the classification to be used is outlined and then the starfishes are taken up, the familiar *Asterias rubens* being used as the type upon which the account of the anatomy is based. This account is very well written, the discussion of the so-called "blood-system" being particularly interesting, though it is quite possible the last word is not yet said on those perplexing structures. Following the anatomical portion are several pages of morphological details where those features in which other starfishes differ from *Asterias* are discussed. The not infrequent defects of these pages are due either to the excusable necessity for brevity, as in the paragraph on "Asexual Reproduction," where statements open to question are made without qualification and much interesting matter is ignored, or to the less excusable lack of acquaintance with a large variety of forms. To this latter cause must be referred the statement that "the families Heliasteridæ and Brisingidæ are characterized by possessing numerous (19–25) arms"; this is an unfortunate half-truth, as the Heliasteridæ have 21–44 arms, while the Brisingidæ have only 8–18. A similar blunder occurs in the paragraph on "spines," where the Echinasteridæ are said to have short, blunt spines, "very numerous and thick set." This statement applies only to the genus *Henricia* and its immediate allies, while the other genera have widely spaced, often very sharp, spines, and in *Acanthaster* (to

[3] "The Cambridge Natural History," Vol. I. * * * Echinodermata. By E. W. MacBride, M.A., F.R.S., formerly fellow of St. John's College, Cambridge; professor of zoology in McGill University, Montreal. London: Macmillan and Co., Limited; New York: The Macmillan Company. 1906. Chapters XVI.–XXI., pp. 427–623, figs. 185–296.

which no reference is here made) are found the longest and most remarkable spines occurring in the whole class. The section on the "Classification of Asteroidea" is thoroughly unsatisfactory and it is particularly annoying that an Englishman should show such a lack of appreciation of Sladen's great work, which despite its defects is certainly the most carefully reasoned and well-grounded classification of starfishes yet published. One is almost inclined to believe that MacBride has never read Sladen's philosophical discussion of the principles of classification in the Asteroidea. The present reviewer dissents emphatically from the principles proposed by MacBride, that "the best method of classification is to take as our basis the different methods in which the demands of the environment have been met," and that "the great differentiating factor in their development must have been the means they adopt to shelter themselves from their enemies";—"One of their chief dangers" "must be regarded as" "assaults by other animals, especially parasites, on their soft and delicate skins." According to these principles, the influence of environment is far more important than heredity, and classification should be based, not on the deep-seated, slowly modified characters, but on superficial externals which are easily modified by changes in the manner of life. It is clear to any one familiar with the great variety of form and external features exhibited by starfishes that "the demands of the environment" have been met in widely different ways by closely related forms, while the converse of this may or may not be true. Moreover, starfishes have comparatively few enemies, after their larval life is past, and certainly are not especially liable to parasites as MacBride assumes. The great majority of species are found more or less exposed on the bottom or, at the most, concealed beneath rocks, and there is not the slightest evidence that the danger from parasites has played the least part in the evolution of the group. In view of his principles, it is not strange that MacBride adopts the classification of Perrier, of which no previous English or American writer has approved, and divides the Asteroidea into five orders, each of which is taken up in turn with its constituent families. The latter are, as a rule, treated very briefly, but the more important are made the subject of many interesting and well-written notes. The chapter closes with a short account of the fossil Asteroidea. The following three chapters deal with the Ophiurans, Echini and Holothurians, respectively, each class being treated in practically the same way as are the Asteroids. The account of the morphology of each class is well-written and very clear, with few mistakes or important omissions. It is to be regretted that the terminology used in connection with the pedicellariæ of the Echini is not that which is now almost universally used by echinologists. Much attention is given the physiological aspects of the structures discussed, and some unconfirmed observations on habits and functions, made by other workers, are accepted apparently without question, even though somewhat improbable. As the classification of the Ophiurans is still very imperfectly worked out, MacBride has done well in following Bell's arrangement, but it is remarkable that the very peculiar genus *Astrophiura*, described by Sladen, is nowhere mentioned, although its obvious resemblance to an Asteroid makes it of great importance in this connection. The classification given for the Echini is apparently original and has much to commend it, particularly its simplicity and the clear-cut groups. Unfortunately it omits the fossil forms (which are, however, discussed in a separate section) and for this and other reasons, it needs some modifications. The classification of the Holothurians is also original, very much so in fact, and it is safe to say will not be adopted by any student of the group, recognizing, as it does, six orders, of which only one contains more than a single family. MacBride gives little heed to either the work or the judgment of Ludwig, the nestor of Echinoderm morphology, and by his use of "Aspidochirota" and his failure to mention the Synallactinæ, he reveals either ignorance or lack of appreciation of recent work on the Holothurians. The chapter on the Pelmatozoa is, at least from a zoologist's point

of view, very satisfactory, and the writer's inclination to the classification of Wachsmuth and Springer for the fossil forms will be generally approved in America. The closing chapter, dealing with the development and phylogeny of the Echinoderms, is very interesting and is almost wholly free from the self-confident assertiveness which mars some of the preceding pages. While the conclusions which are reached as to the steps in the evolution of the type, and as to the interrelationships of the classes, need not always be approved in detail, it must be admitted that the author has made out a good case. The relationship of the Echini and Holothurians is well emphasized, as is the more obvious one between Asteroids and Ophiurans, but the evidence supporting the derivation of Echini from Asteroids is weak and it is difficult to believe that we are at this point on the true line of descent. It seems clear that MacBride has been somewhat unduly influenced by his familiarity with the development of *Asterina gibbosa,* and it is quite probable that his continued researches into the development of species of the other classes will ultimately lead him to somewhat different views from those he now holds. A word as to the illustrations is in order. About one third are original, the remainder being taken from such reliable authorities as Ludwig, Loven, Sladen, Wyville-Thomson, *et al.* Scarcely one is from a photograph, even such forms as *Asterias* and *Astropecten* being represented by drawings. While the diagrammatic sketches showing structure are always clear, and the original ones are particularly good, photographs of *Asterias, Ophiothrix, Echinus, Echinarachnius, Holothuria,* etc., would have been a great improvement on the rather crude sketches given. There are one or two mistakes made in identifications: thus the "Schizaster" figured on page 556 is certainly not *Schizaster,* but appears to be *Brissopsis,* while the *Salenia* figured on page 538 is not *varispina,* but *hastigera,* though this latter mistake is Wyville-Thomson's and not MacBride's. In conclusion, this review may be summed up as follows: the morphological, physiological and embryological portions of the text are excellent, though occasionally marred by an unnecessary dogmatism; the geological references are somewhat less satisfactory; while the ecological and systematic portions, and nearly all the illustrations of entire animals, range from mediocre to poor.

HUBERT LYMAN CLARK

*The Principles and Practice of Surveying.* By BREED and HOSMER. New York, Wiley and Son.

Of all the subjects taught in engineering schools, surveying, so-called, is one of the least satisfactory, both to the professor responsible for the instruction, and to the outside engineers who later test the value of the instruction in the light of the practical ability realized by those taught. This is doubtless due to two causes; first, on account of the large number of students and the small amount of time given to the subject, there is opportunity for giving to the individual little more than a bare insight into the methods of handling transit and level; and second, the use of those instruments in construction work involves very little of the time-honored methods indicated in the text-books for surveying farm areas and making differential profiles.

That the present methods are unsatisfactory is indicated in no clearer way than by the number of text-books on the subject, each school trying apparently to solve the problem of securing better results by the use of a new text-book which varies from that of some other school in the details of description of instruments or directions for field work.

The volume under review is the result of the experience of two instructors in the Massachusetts Institute of Technology, and embodies their ideas of what should be presented to the student who is taking up the subject of surveying for the first time. It is carefully and logically arranged for this purpose, giving descriptions in detail, emphasizing directions of what is, and what is not, proper procedure, and listing under each instrument and method, "common sources of error" and "common mistakes."

The book itself of 433 pages is divided into

four parts, the first 94 pages being devoted to the description and uses of instruments, the next 224 pages to methods of field work, the next 58 pages to computation, and the remaining 57 pages to mapping and draughting; an arrangement admirably adapted to a clear presentation of the subject. The detail of these four sections is well worked out. For example, in part I., a series of diagrams shows all the types of transit verniers; the Berger top attachment is used to show the theory and operation of the solar compass; the measurement of angles by repetition is explained and the value insisted on; and the tape rod for reading elevations direct, is explained and commended. In part II., the usual methods of land surveying are explained, and many details are given which show the practical experience of the authors. The chapter on Topographical Surveying is particularly satisfactory. The chapter on Mining Surveying is written by Blamey Stevens, M.Sc., of Ellamar, Alaska, and the field and office methods of underground work are carefully explained. In the chapter on leveling, the advantage in accuracy of double rodded lines is carefully pointed out and in the chapter on city work, the simpler methods of running out and recording curves are shown. A brief description of methods of triangulation is also given. In part III., emphasis is laid on the accuracy of computations, on the significance of the number of digits employed and on the proper forms for computation. Models are given in details for land area determinations and for earth volume determinations and these form the chief part of this section. In part IV. are given many hints referring particularly to surveying draughting, such as the use of water colors for ready-made inks, the checks on field work made possible by a critical study of the plot, and methods of finishing and filing drawings.

The usual tables complete the volume, which is probably as satisfactory a text-book under present methods of technical school instruction in surveying as can be written.

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## *SCIENTIFIC JOURNALS AND ARTICLES*

*Bird-Lore* for May–June opens with "A Sketch of the Thrushes of North America," by Jonathan Dwight, illustrated by a colored plate and maps of distribution. B. S. Bowdish furnishes an account of "The Rose-breasted Grosbeak"; and Emma E. Drew tells of "Some Bird Acquaintances," made while confined to an invalid chair on the veranda of an Adirondack cottage. A list of 140 species observed from such a restricted point of observation shows what may be done right at home. The Educational Leaflet, by Mabel Osgood Wright is devoted to "The Baltimore Oriole" and the section devoted to "The Audubon Societies" shows that, thanks to these same societies, laws for the protection of birds are gradually being enacted throughout the United States.

The Bulletin of the Charleston Museum for May is mainly devoted to a "Synopsis of the Bird Records of the Natural History Society for the year 1906."

The preparation of an index to the first twenty-five volumes of the *Astrophysical Journal* is now under consideration. If sufficient support is secured, the index will be issued during the autumn of 1907, at a price of $1.50 or $2.00.

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## *SOCIETIES AND ACADEMIES*

### THE AMERICAN CHEMICAL SOCIETY. NEW YORK SECTION

The last regular meeting of the session of 1906–07 was held at the Chemists' Club, 108 West 55th Street, on June 7.

The following papers were presented:

F. D. Dodge: "Methyl Salicylate, Natural and Synthetic."

K. George Falk: "Ignition Temperatures of Mixtures containing Carbon Monoxide" and "Autoxidation of Organic Compounds: Review."

C. M. Joyce,
*Secretary*

## DISCUSSION AND CORRESPONDENCE

### A NECESSARY AMENDMENT IN THE APPLICATION OF THE LAW OF PRIORITY IN ZOOLOGICAL NOMENCLATURE

THE keystone of all nomenclature of species and genera is the rigid and exceptionless application of the law of priority; without it no uniformity could be attained. There is practically complete agreement on this point among all who have had considerable experience in the definition of genera and species, that is, among those who best understand the difficulties of reaching ultimate agreement.

Now the International Code of Zoological Nomenclature has adopted the following:

> Art. 25. The valid name of a genus or species can be only that name under which it was first designated on the condition:
>
> (*a*) That this name was published and accompanied by an indication, or a definition, or a description; and
>
> (*b*) That the author has applied the principles of binary nomenclature.

It is clear that the ruling of clause (*a*) allows too much laxity and is too indefinite. The amendment that has probably occurred to others, and that I would urge as most necessary, is the change of clause (*a*) to read as follows:

> That this name was published accompanied by a published recognizable description or by a published recognizable drawing.

Publication is to be understood as meaning expression in print; and "recognizable," a description or drawing sufficiently accurate and detailed for distinguishing the species or genus named from any other species or genus known at the time when the name was applied. A few considerations among many may be mentioned to justify this amendment.

In the first place, as the code rules at present it is only necessary for a systematist to publish a name in accordance with the other rules of binary nomenclature, and to give an "indication," indicating, *e. g.*, a particular type specimen in a particular collection; he is really not obliged to give any description whatsoever, or he may give an indifferent or even an inaccurate description provided he makes this indication. In time this loophole will lead to the utmost confusion; it would be impossible to get any idea of a newly named species without resource to the type specimen. This is the main reason for eliminating from the clause in question the vague and meaningless word "indication"—vague and meaningless unless it signifies the indication of a particular specimen. Surely it is not the spirit of scientific nomenclature to point to a specimen as an idea!

In the second place, it is becoming more and more necessary that the name should be accompanied by a recognizable description or drawing. There are many of the most modern systematists, as well as large numbers of the earlier ones, whose diagnoses are worthless for purposes of positive identification. These diagnoses either do not mention the important characteristics, or do not describe them fully or accurately enough, or else do not draw comparisons with the closely allied forms. If there is one thing we want to get out of the description of a new species, it is the item of how it differs from the known forms of the same group. Such descriptions are a positive hindrance to systematic progress, they may even arrest it entirely. They are scientifically valueless, they vilify the journals containing them. Under the present code one must have resource to the type specimen. Suppose then I am monographing a particular group, and find in the literature some papers in which the descriptions are practically meaningless; then I must ask for the loan of the specimens; but they may be in a museum the rules of which forbid the loaning of types; then I must in person visit that museum to find perhaps that the specimens have been mutilated beyond recall or have even been lost. Or should I wish to undertake the revision of the species of a comprehensive genus, say *Epeira* or *Bulimulus*, then I should have to undertake a *Weltreise*, for which my finances would probably be inadequate, and visit practically every museum in the world. Then everyone knows how type specimens suffer from handling, how perishable the average dried or alcoholic specimen is. The mere statement that a type specimen exists in such a collection is not the spread of a scientific

knowledge. Suppose a man should undertake a review of the present status of the problems of evolution; would we not expect that he would at least describe the various theories? Would it not be ridiculous for the reviewer to give simply a list of books and papers, and indicate in what libraries these are to be found? Science can make no advance when nothing but names are given, or only unrecognizable descriptions, with the indication where specimens are to be found. The retention of a type specimen is always desirable for future reference, but the publication of a good description is the *sine qua non* of scientific advance.

Those who take the pains to furnish adequate descriptions, and who draw comparisons with the previously known species, will always be regarded as the original describers whether the rules of nomenclature give them credit or not.

The suggestion of demanding a recognizable description is, of course, open to the objection that it is difficult to decide what constitutes a recognizable diagnosis. The decision must be made separately for each particular case. All would concur in the fairness of the principle to consider the adequateness of the description at the time when it was made. A description would be recognizable if at the time it was published it served to demarcate the species from all the other then known species of the genus, or the genus from all the other then known genera of the family. Questions of this kind can generally be decided by any monographic reviser of a group.

As the case stands at present there is all incentive for hasty and insufficient diagnoses, at least our codes do not prevent them. We have either to hunt up the type specimen, to spend fruitless hours to try to read some meaning into a description, or to try by the unsafe method of elimination to determine what species an author intended. As the A. O. U. Code of 1886 put it, "Zoological nomenclature is a means, not an end, of zoological science"; it ought to make the path clear and not maintain obstacles. Too much of a premium is placed upon age, there is too strong a tendency to resurrect the oldest name and try to fit to some particular species, whether it was accompanied by a good diagnosis or not. So long as this continues so long will the names in use be unstable.

Personally, I never have and never will regard a name as tenable unless it is based on a recognizable description or drawing, and that whether type specimens are preserved or not. There are many who share this view, and in this connection attention may be drawn to the very cogent recent arguments of Looss.[1] We are all in sympathy with the endeavors of the International Committee, most of us realize the difficulty of the questions it has to decide, and we are ready to relinquish personal views in order to reach uniformity. But there will never be uniformity of opinion in regard to the matter of allowing a name to be based simply upon an "indication." New names are multiplying in a geometrical ratio, some of them newly coined and others raked out of the ash heap of describers who deserve oblivion; few genera have been thoroughly revised; if mere "indications" and inadequate descriptions continue to be permitted the task of revision will before long be hopeless. Then there will be need for far more radical reform than the one here suggested. Now while our rules are still plastic let us insist on the absolute necessity of adequate diagnoses of genera and species. Thus insecurity may be abolished, each describer be given his just due and no more, and science as well as nomenclature be benefited.

One recommendation the committee might embody in the code to clarify future systematic work, though, of course, it could not be applied to the work of the past. That is, that when structural characteristics enter into a diagnosis they should be represented so far as possible by drawings rather than by words. A drawing is immediately clear, few descriptions are. Above all it is often very difficult to build a conception of a structure from a brief Latin description since the Latin is too poor in adjectives for our present needs. Describers are too intent upon their own convenience, give too little attention to the con-

[1] *Zoologischer Anzeiger*, 1907, Nr. 19.

venience of those who have to read their descriptions. This recommendation will be of great aid in identifying species and genera and will help towards that end when men will see there is honor in furnishing good diagnoses, but no honor in simply naming species.

THOS. H. MONTGOMERY, JR.
THE UNIVERSITY OF TEXAS,
June 4, 1907

### ANOTHER WORD ON THE VULTUR CASE

MY brief allusion to Dr. Allen's inconsistency in his latest elimination of *Vultur* seems to have been clear to all with whom I have discussed the question except Dr. Allen, who fails entirely to see my point.

It seems necessary, therefore, to restate the matter. The case is as follows:

*Sarcorhamphus* 1806.
  gryphus.
  papa = type of Gypagus 1816.
  auricularis = type of Torgos 1828.
*Cathartes* 1811.
  papa = type of Gypagus 1816.
  aura.
*Gypagus* 1816.
  papa.
  gryphus = type of Gryphus 1854.

Dr. Allen says that while *gryphus* is the type of *Sarcorhamphus* it was not the type in 1806 and only became so in 1828 by the removal of the other species. Therefore, he claims that in eliminating *Vultur* we have no right to remove *gryphus* at 1806 and can only remove it at the date at which *it became* the type of *Sarcorhamphus*.

This is absolutely contradictory to his own practise in all other cases, nor can I find a precedent in the "current usage" of other eliminators. For instance, *papa* is the type of *Gypagus* 1816, but it was not the type in 1816, and only became such in 1854; and yet Dr. Allen in all his eliminations removes *papa* at 1816, which any one can see is the date of establishment of the genus, not the date at which *papa* became its type. To be consistent *gryphus* must, of course, be removed at 1806, as I stated previously. Dr. Allen's recent note in which he repeats that *papa* must be removed at the date at which its genus was established, while *gryphus* must be removed at the date it became the type of its genus, only emphasizes his inconsistency—an inconsistency which is too self-evident to require the employment of any "imagination."

WITMER STONE
ACADEMY OF NATURAL SCIENCES
OF PHILADELPHIA,
May 24, 1907

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## SPECIAL ARTICLES

### RELATION BETWEEN BIRTH RATES AND DEATH RATES

A SHORT notice appeared on page 641 of SCIENCE, 1907, of a paper read by C. E. Woodruff before the American Association for the Advancement of Science, on the relation between birth rates and death rates, etc.

In this connection, it may be of interest to note that a mathematical expression can be obtained for the relation between the birth rate per head $b$ and the death rate per head $d$, for the case where the general conditions in the community are constant, and the influence of emigration and immigration is negligible.

Comparison with some figures taken from actual observation shows that these at times approach very nearly the relation deduced on the assumptions indicated above.

I give here the development of the formula, and some figures obtained by calculation by its aid, together with the observed values, for comparison.

Let $c(a)$ be such a coefficient that out of the total number $N_t$ of individuals in the community at time $t$, the number whose age lies between the values $a$ and $(a+da)$ is given by $N_t c(a)da$.

Now the $N_t c(a)da$ individuals whose age at time $t$ lies between the values $a$ and $(a+da)$, are the survivors of the individuals born in time $da$ at time $(t-a)$.

If we denote by $B_{(t-a)}$ the total birth rate at time $(t-a)$, and by $p(a)$ the probability at its birth, that any individual will reach age $a$, then the number of the above-mentioned survivors is evidently $B_{(t-a)}p(a)da$.

Hence:

$$N_t c(a)\,da = B_{(t-a)}p(a)\,da$$

$$c(a) = \frac{B_{(t-a)}}{N_t} p(a)$$

Now if general conditions in the community are constant, $c(a)$ will tend to assume a fixed form. A little reflection shows that then both $N$ and $B$ will increase in geometric progression with time,[1] at the same rate $r = (b - d)$. We may, therefore, write:

$$B_{(t-a)} = B_t e^{-ra}$$

$$c(a) = \frac{B_t}{N_t} e^{-ra} p(a)$$

$$= b e^{-ra} p(a) \qquad (1)$$

Now from the nature of the coefficient $c(a)$ it follows that

$$\int_0^\infty c(a)\, da = 1$$

Substituting this in (1) we have:

$$\frac{1}{b} = \int_0^\infty e^{-ra} p(a)\, da \qquad (2)$$

Equation (1) then gives the fixed age-distribution, while equation (2) (which may be expanded into a series if desired), gives the relation between $b$, the birth rate per head, and $r$, the rate of natural increase per head, and hence between $b$ and $d$, since $r = b - d$.

Applying these formulæ to material furnished by the Reports of the Registrar-General of Births, etc., in England and Wales, the following results were obtained:

ENGLAND AND WALES 1871–80 (MEAN)

| | | Observed[2] | Calculated |
|---|---|---|---|
| Birth-rate per head ..... | $b$ | .03546 | .0352 |
| Death-rate per head ..... | $d$ | .02139 | .0211 |
| Excess ..... | $(b - d) = r$ | .01407 | (.0141) |

$p(a)$ from Supplement to 45th Ann. Rep. Reg. Gen. Births, etc., England and Wales, pp. vii and viii, assuming ratio:

$$\frac{\text{male births}}{\text{female births}} = 1.04.$$

[1] Compare M. Block, "Traité théorique et pratique de statistique," 1886, p. 209.

[2] Mean $b$ and $d$ from 46th Ann. Rep. Reg. Gen. Births, etc., England and Wales, p. xxxi.

*Age Scale.*—1,000 individuals, in age-groups of 5 and 10 years

| $a_1 a_2$ | | $1000 \int_{a_1}^{a_2} c(a)\, da$ |
|---|---|---|
| 0 – 5 | 136 | 138 |
| 5 – 10 | 120 | 116 |
| 10 – 15 | 107 | 106 |
| 15 – 20 | 97 | 97 |
| 20 – 25 | 89 | 87 |
| 25 – 35 | 147 | 148 |
| 35 – 45 | 113 | 116 |
| 45 – 55 | 86 | 87 |
| 55 – 65 | 59 | 59 |
| 65 – 75 | 33 | 33 |
| 75 – ∞ | 13 | 13 |

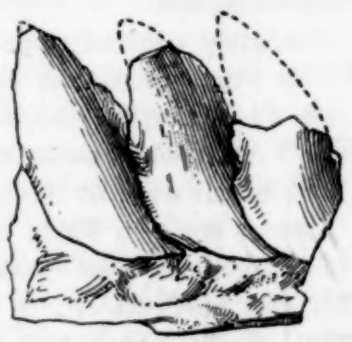
It will be seen that in the above example the values calculated for the age-scale and especially for $b$ and $d$, snow a good agreement with the observed values.[3]

The above development admits of further extension. But this, as well as further numerical tests, must be reserved for a future occasion. In view of the recent note of the work by Major Woodruff, it appeared desirable to the writer to publish this preliminary note.

ALFRED J. LOTKA

## A NEW GENUS AND SPECIES OF FOSSIL SHARK RELATED TO EDESTUS LEIDY

THE specimen which serves as the type of the new genus and species, *Lissoprion ferrieri*, was secured in what are regarded as Permo-Carboniferous deposits near Montpelier, Bear



Lake County, Idaho. It was collected by Mr. W. F. Ferrier, of the town mentioned. The specific name is given in his honor. The

[3] The calculation is based on the observed value of $r = .0141$, as indicated by the brackets.

specimen was transmitted to me by Mr. Fred Boughton Weeks, of the U. S. Geological Survey.

Three segments are represented in the specimen, as shown in the drawing. As in *Edestus,* there are enameled crowns of teeth supported on a shaft of vasodentine. Two of the crowns are practically complete, the third lacks a considerable portion. Much of the shaft is splintered off, so that its form and dimensions can not be determined.

Evidently our fossil does not belong to the genus *Edestus,* for not only are the bases of the teeth fused so that no traces of the constituents appear in the shaft, but the crowns themselves are fused to more than one half their height. The crowns differ from those of all the known species of *Edestus* in being devoid of all serrations. The crowns of *E. giganteus* are of nearly the same form and are so closely placed that their edges overlap, but they are not fused.

Karpinsky in 1899 described a remarkable genus, *Helicoprion,* related to *Edestus,* in which a series of about 150 teeth form a spiral of 3½ whorls. From the Idaho specimen it is impossible to determine the extent of the whole series or how much it curved during life. However, it certainly was not a species of *Helicoprion;* for the crowns of the latter are serrated, narrow, elongated, bent forward at a moderate angle, and prolonged so as to reach beneath the second crown forward and nearly to the base of the shaft. In *Lissoprion ferrieri* the crowns are broader, much shorter, more abruptly turned forward, and prolonged only to the middle of the next crown and far from the base of the shaft.

Another genus, *Campyloprion,* was proposed by Dr. C. R. Eastman, in 1902, which had for its type *C. annectans* Eastman and included *Edestus davisii* H. Woodward and *E. lecontei* Dean. The species were believed to have had a bent but not volute shaft and fewer teeth than *Helicoprion;* while they differed from *Edestus* in having crowns of different form and bases thoroughly fused.

In 1903 Dr. Eastman appears to have concluded that his species *annectans* belonged really to *Helicoprion* and he therefore substituted, as type of *Campyloprion, Edestus lecontei.* This substitution is not permissible, according to the rules of nomenclature. If *annectans* is really a species of *Helicoprion, Campyloprion* becomes a synonym of the former; and *Edestus lecontei* and *E. davisii* require a new generic name.

*Lissiprion ferrieri* differs from *Edestus lecontei* in various respects. The crowns of the teeth of the latter are narrower, higher, the divisions between the bases are seen to descend to near the base of the shaft and the slope of the axis of the tooth is rather forward than backward. It does not appear probable that the two species belong to the same genus.

Whether or not there was a longitudinal median channel along the under side of the shaft of *Lissoprion,* as in *Helicoprion,* can not be determined from our specimen.

The anterior end of the specimen is broken at right angles with the axis of the shaft and from it we can learn something of the internal structure. A figure of this would be practically identical with that presented by Karpinsky of the shaft and crown of his *Helicoprion.* The central portion of the section is occupied by a triangular core of spongy vasodentine. Near the base of this triangle are seen the longitudinal canal of the shaft and a smaller canal alongside of it. At the top of the triangle is the canal which leads into the broken crown. The triangle has its base near the lower border of the specimen, and it is probable that this border is very close to the roof of a longitudinal channel. On each side of the mass of spongy vasodentine are the denser layers of vascular and tubular dentine and, outside of all, the enamel of the crown.

The structure above described shows that the bases of the teeth, originally distinct, have become fused so completely that the boundaries between them no longer appear even in the microscopic structure.

The following diagnosis of the genus *Lissoprion* may be given:

Symphysial dentition, a series of fused teeth of unknown number, with broad, high, and laterally compressed crowns, without serration, the crowns fused for the greater part of

their height, the lower portion of each suddenly contracted, shortened and turned forward, and lacking much of reaching the base of the shaft. Bases of all the teeth indistinguishably fused into a shaft which was probably more or less curved. Median longitudinal channel at the base of the shaft probably, but not certainly, present.

DIMENSIONS OF L. FERRIERI

| | Mm. |
|---|---|
| Greatest extent of the crown of hinder tooth | 44 |
| Greatest anteroposterior breadth of same crown | 17 |
| Thickness of base of same crown | 13 |

The figure of the specimen is two thirds the natural size.

OLIVER P. HAY

## COON MOUNTAIN CRATER

CONSIDERABLE interest has been manifested during the past year or two concerning the origin of a remarkable crater-like depression located on the summit of a slight elevation known as Coon Mountain or Coon Butte. It may be found on the plateau region of northern Arizona, but slightly removed from a locality of recent extreme volcanic activity where over a hundred volcanic cones may be seen, many of which still possess well-defined craters. Interest in this phenomenon has been revived as the result of the adoption and elaboration on the part of a few writers of the local common talk of the inhabitants of the immediate neighborhood of the mountain. Here it is religiously believed that an immense meteor nearly one half mile in diameter buried itself in the earth, forming a deep cavity with an upturned edge or rim very much as when a bullet is allowed to fall into soft mud. Some of the reasons cited for this belief are: (1) The circular shape of the depression, (2) the large amount of meteoric iron fragments[1] (over ten tons) which has been collected in the immediate vicinity, and, (3) the entire absence of all kinds of volcanic ejectamenta, or even heated or metamorphosed material, within the area covered by a radius of several miles.

During the summer of 1906 the writer, while studying the crater cones and lava flows of the San Francisco Mountain district, incidentally made a visit to this interesting locality and this report is the result of the impressions received at that time.

An admirable description of the elevation has recently been presented to the public through the publications of D. M. Barringer and B. C. Tilghman,[2] as well as the results of the investigations which they made by means of shafts and borings in the bottom of the crater in search of the great meteorite. It is sufficient here to call attention to only a few of the most important facts. The crater is about 3,500 feet in diameter and nearly 600 feet deep. The elevation on which it is located is about 150 feet above the surrounding planes and from a distance presents the appearance of a narrow circular wall with a very jagged summit. The rocks in the immediate vicinity and also forming the walls of the crater, are made up of layers of sandstone of greatly varying composition. The cementing material is calcareous matter which in some places is present in sufficient quantities to classify the rock as a silicious limestone. The whole formation is known as the Aubrey limestone (and sandstone).

The strata is upturned, forming the rim of the crater exactly as one would expect if it had been lifted by some force from below. It has been frequently faulted and displacements of a few feet can readily be seen in several places on the walls of the crater. The most remarkable feature to be observed, however, is the complete absence of any evidence of vulcanism. No lava is found and not the slightest metamorphism of any kind has taken place in the sediments. Further, there is no evidence of solfataric action, or changes of any kind except mechanical erosion, having taken place after the cavity was formed. The nearest lava fields are located nearly fifteen miles distant. These are in the vicinity of San Francisco mountain and are associated with a remarkable crater cone known as Sunset Peak, an elevation made up of fine ash, lapilli, and lava blocks. In the lava blocks are frequently found masses of

[1] Known as the Cañon Diablo meteorites.

[2] "Coon Mountain and its Crater," by D. M. Barringer, and "Coon Butte, Arizona," by B. C. Tilghman, *Proc. Acad. Nat. Sc. of Phil.*, December, 1905.

sandstone mostly changed to quartzite which have become included during the penetration of the sedimentaries by the molten magma. In the minds of the uninitiated this crater cone must have been produced by quite different agencies than were at work on Coon Mountain, whereas probably the difference lies in the degree and not the kind of action. It would seem quite probable that, on the border of a region of such extreme volcanic activity as has given rise to the most lofty mountains in Arizona, there might have been an explosion lacking the energy necessary to bring the igneous mass or even fragments of it to the surface. Further, the recession of the magma, accompanied by whatever portions of the strata had become metamorphosed by contact, would account for the precipitous walls of the crater as well as the absence of fused material. The explosion may have been of rather an incipient nature, throwing comparatively little of the material outside of the crater, although, considering the nature of the material, soft sandstone, whatever blocks had been thrown out could easily have become disintegrated and simply added to the mesa soil already made up of the same material. On the southern slope of the crater there are found quite a number of sandstone blocks. Whether these were actually thrown out of the crater or simply broke off from the crumpled rim and rolled down the slope can not be determined.

It would seem, then, that the phenomenon exhibited here can be satisfactorily explained as having been produced by an explosion followed by an entire lack of volcanic activity, as first explained by G. K. Gilbert, of the United States Geological Survey. The meteorites found here probably had nothing to do with the formation of the depression. The earth either encountered a meteoric swarm or, what is more likely, a large meteor fell to pieces on striking the earth's atmosphere. The latter hypothesis is considered more probable, for the reason that one would expect a swarm to have had the fragments spread out to a greater extent than is evidenced by the rather confined area in which they are found. It is to be concluded, then, that these two striking phenomena are simply coincidences and should not be interpreted as cause and effect.

The endeavor to explain the origin of the crater by some other than volcanic agencies has led some writers to suggest that it may have been produced by solution. According to this hypothesis the depression was caused by the falling in of the top layers of strata forming the roof of a nearly circular cavity which was a portion of an underground water way. This is supposed to have been the cause of the existence of the peculiar circular depression located near Camp Verde known as Montezuma's Well. Water still exists here and the fact that it never becomes stagnant or brackish is well known. This hypothesis can not be applied to Coon Mountain, however, for the reason that it leaves unexplained the most noticeable feature of the phenomenon, namely, the upturned strata which forms the rim. This could have been produced only by means of forces working from below.

F. N. GUILD

UNIVERSITY OF ARIZONA,
January 22, 1907

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## *CURRENT NOTES ON METEOROLOGY AND CLIMATOLOGY*

### MONTHLY WEATHER REVIEW

THE articles of most general interest in Nos. 1 and 2, Vol. XXXV., 1907, of the *Monthly Weather Review* are as follows:

"Is not Honesty the wisest Policy?" is the title of a brief note by Professor Cleveland Abbe, in which it is pointed out that the officials and observers of the Weather Bureau are often urged by interested persons not to report tornadoes, or frosts, or droughts, or other meteorological phenomena, because of the injury which may be done by such announcements to local business enterprises and land booms. Professor Abbe rightly puts strong emphasis on the fact that it is a wrong "to mutilate or suppress the record of an observation of a phenomenon of nature" as it is "also wrong to make a bad use of the record."

"The Adirondack Rainfall Summit," by R.

E. Horton. An analysis of the rainfall over the Adirondack plateau, based on the records of twenty-five stations, reduced to the uniform period 1901–5. A map with 1,000-foot contours, the principal watershed lines and isohyetals is given, as is a profile along lat. 43°30′ N., extending eastward from Lake Ontario on a line running a few miles south of North Lake. There is evident a rapid increase of rainfall with altitude on the southwest slope; then a rapid decrease as the altitude increases proceeding northeast. The maximum rainfall is shown enclosed by the isohyetal line of 55 inches.

"The Climate of Kansas," a copy of the stenographic report of a hearing before the Committee on Agriculture of the House of Representatives on January 8, 1907, at which the Chief of the Weather Bureau testified, together with a supplementary note prepared by Professor Moore in order to counteract certain erroneous statements which found their way into the papers in regard to his testimony. The purpose of the testimony and of the supplementary statement is to show that there has been no permanent change in the climate of the central portion of the Great Plains since Weather Bureau records have been kept.

"The Climate of Yukon Territory," by R. F. Stupart, director of the Meteorological Service of Canada. A study of all available records.

"Problems in Meteorology," by C. F. von Herrmann and Professor Cleveland Abbe; continuation of a paper begun in the December, 1906, number of the *Review*.

"The Growth of Fog in Unsaturated Air," by Frank W. Proctor.

"Notes of a Meteorologist in Europe," by Professor A. J. Cox, who has recently visited the chief meteorological centers of Europe.

"Meteorological Work at Camp Wellman, Dane's Island, Spitzbergen," gives the results of meteorological observations made by H. B. Hersey, of the U. S. Weather Bureau, who accompanied the Wellman expedition as meteorological observer. The period covered is June 26 to August 31, 1906.

"A Climatic Sketch of Tacoma, Wash.," by E. B. Gittings, Jr. "The object of this sketch is to present in popular form as complete a description of the climate of this station as is possible without the introduction of extensive tabular compilations of data."

"Snow Rollers at Canton, N. Y.," by M. L. Fuller. An illustrated account of some well-developed snow rollers formed on February 19, 1907.

"Long-Range Seasonal Forecasts for South Africa," by Professor Abbe; a review of recent investigations by Mr. D. E. Hutchins, conservator of forests for South Africa. Sunspots have nothing to do with the variations of rainfall, but Mr. Hutchins has shown that there are certain correlations between the rainfall on the east and on the west, so that when one goes up the other goes down.

"Panama Rainfall," by Professor E. B. Garriott; a general description of the rainfall conditions and amounts, which brings clearly to view the controls, average amounts and the relation to the canal construction.

"Fog on the Newfoundland Banks," by C. T. Brodrick; a bibliographic study of these important fogs, and of the different methods of charting them.

We are glad to note the publication of an excellent index to Vol. XXXIV (1906) of the *Monthly Weather Review*. We have, on previous occasions, called attention to the fact that the index of the *Review* has in the past been very unsatisfactory.

### BUCHAN

To the names of von Bezold, Paulsen and Russell, whose work for meteorology has recently been brought to a close by death, we must now add the name of Buchan. Alexander Buchan (1829–1907) began his real activities in meteorology in 1860, when called to Edinburgh to be secretary of the Scottish Meteorological Society, in which position he did most effective work of a pioneer kind in organizing, collecting and publishing meteorological observations. He published his "Handy Book of Meteorology" in 1867 (second edition, 1868), and his "Introductory Text Book of Meteorology" in 1871. Buchan

was the first to trace the path of a "low" across the Atlantic, and to chart the mean pressure of the atmosphere and the prevailing winds of the globe. His best-known work is probably that in connection with the meteorological discussions of the *Challenger* expedition. He was more recently associated with Dr. A. J. Herbertson in the preparation of the splendid "Atlas of Meteorology." He was from the beginning actively interested in Ben Nevis Observatory, and published several discussions of Ben Nevis meteorology. Buchan was a member of the Meteorological Council (1887); an honorary LL.D. of Glasgow; F.R.S. of London and Edinburgh; the first recipient of the Symons Medal of the Royal Meteorological Society; an honorary member of numerous foreign scientific societies. Dr. W. N. Shaw (*Nature*, May 23) well says: "It is not too much to say that the work of Buchan's life has contributed largely to justify the claim of meteorology to be regarded as a separate scientific subject, entitled to separate academic recognition."

R. DEC. WARD

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### *THE RUSSELL SAGE INSTITUTE OF PATHOLOGY*

MRS. RUSSELL SAGE has given the sum of $300,000 to found what will be known as the Russell Sage Institute of Pathology as an adjunct to the City Hospital on Blackwell's Island. The securities for that amount have been delivered to the Russell Sage Foundation, and the gift has been formally accepted by the Medical Board of the City Hospital.

Resolutions were adopted by the board thanking Mrs. Sage for this magnificent gift, and expressing appreciation for the honor conferred upon the hospital, "realizing that this has been the first occasion upon which a municipal hospital in this city has been so generously provided for by a private individual for the purpose of fostering medical education and research. "It is the hope of the Medical Board," the resolutions continue, "that this gift of Mrs. Sage may establish a precedent for others which may lead to like endowment in other municipal institutions."

Commissioner Hebberd of the Department of Public Charities has issued a statement in which was laid down the terms of the gift as received in a communication from Mr. Robert W. De Foster, counsel for Mrs. Sage. Mr. De Foster's letter on the subject said:

> This institute is to be organized according to the plans and under the direction of Drs. E. G. and T. C. Janeway, with whom are to be associated on the board of trustees, as *ex-officio* members, the Commissioner of Public Charities of the City of New York and the president of the medical board of the City Hospital, and as individual members Dr. D. Bryson Delavan, Dr. Simon Flexner and Professor Graham Lusk. The institute will be promptly incorporated.
>
> The effective work of the institute depends, as you have stated, upon the maintenance and continuance of the helpful relations between the Department of Public Charities and those who are now performing the duties of pathologists to these hospitals. The income of the institute from this source will be based upon the continuance of such cooperation to the satisfaction of the gentlemen named as trustees.
>
> Mrs. Sage hopes that as the result of this endowment the research and educational work of these hospitals will be largely increased, to the good of the general public, and particularly in dealing with the diseases to which old age is liable.

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### *SUMMER FIELD MEETING OF THE SECTION OF GEOLOGY AND GEOGRAPHY OF THE AMERICAN ASSOCIATION*

IN the issue of SCIENCE for May 10 was given the full program of the meeting of Section E—Geology and Geography—of the American Association for the Advancement of Science, from July 3 to 11. It may be added that the subject of the address of Dr. Lane, the vice-president, is "The Early Surroundings of Life." It will be given in the auditorium of the Catholic Summer School, and will be complimentary to the members of the Champlain Assembly. The noon addresses to be given each day after the lunch hour on a subject connected with the excursion of the day have been arranged as follows: "Abandoned Shorelines," by Professor Woodworth; "Iroquois Extinction," by Professor Fairchild; "Paleogeography of the Cambro-Siluric of the Region from the Standpoint of

the Stratigraphy," by Professor Cushing; "Lake Champlain," by Dr. Clarke; "Blastoidocrinus and its Type," by Professor Hudson; "The Lower Siluric Paleography of the Champlain Basin," by Dr. Ruedemann; "The Iroquois Beach and Related Features Northeast of Watertown, N. Y.," by Mr. Taylor; "The Adirondack Iron Ores Deposits," by Professor Kemp.

Those who attend the meeting may purchase local excursion tickets to Plattsburg. From many places these tickets are as low as one and one third single fare. The Trunk Line and New England Associations, Canadian Pacific Railway, Grand Trunk Railway, and Canada Atlantic Railway have made a special rate on the certificate plan of one full fare going and one third full fare returning plus 25 cents for certificate fee, which shall be paid to the agent when purchasing return ticket. Tickets for the going journey may be bought and certificate procured from June 11 to September 30. Tickets returning will be good to October 2. In this case tickets should be purchased to Cliff Haven, and the certificates should be procured for "The Catholic Summer School of America." In order to take advantage of this one and one third fare the sum of $1.50 must be paid for membership in the Catholic Summer School. Rooms may be secured at $1.00 a day in the buildings of the Summer School. Members may take their meals at the Champlain Club; breakfast, lunch or supper, 50c.; dinner, 75c. At the Hotel Champlain the rate will be $4.00 a day and upward.

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## *SCIENTIFIC NOTES AND NEWS*

Dr. E. H. Sellards, for three years geologist and zoologist to the Florida University, has been appointed state geologist of Florida by Governor Broward. The vacancy at the university will probably be filled by the appointment of a zoologist.

Dr. E. A. Ruddiman, professor of materia medica and pharmacy at Vanderbilt University, Nashville, has been appointed chief food and drug inspector of the Department of Agriculture.

Yale University has conferred the degree of doctor of science on Professor Joseph P. Iddings, who holds the chair of petrology in the University of Chicago, a graduate of the class of '77; and on Dr. A. B. Macallum, who holds the chair of physiology in the University of Toronto. The university has conferred the doctorate of laws on Dr. Herbert Putnam, librarian of congress.

At the fifth annual commencement of the College of Medicine of the University of Nebraska, the address was made by Dr. Nicholas Senn, of Chicago. The doctorate of laws was conferred on Major James Carroll, U. S. A.

Professor Charles S. Denison, of the University of Michigan, has received the degree of doctor of science from the University of Vermont, from which institution he received the degree of civil engineer in 1871.

Amherst College has conferred its doctorate of laws on Mr. Percival Lowell, the astronomer and author.

Oxford University has conferred honorary doctorates of science as follows: Sir Norman Lockyer, K.C.B., F.R.S., director of the Solar Physics Observatory, South Kensington; Sir Richard Douglas Powell, K.C.V.O., physician extraordinary to the king, president of the Royal College of Physicians; Sir William Ramsay, K.C.B., F.R.S., professor of chemistry at University College, London; Sir William Henry Perkin, F.R.S.; William Watson Cheyne, C.B., F.R.S., professor of surgery at King's College, London, and Ludwig Mond, Ph.D., F.R.S.

Cambridge University has conferred the degree of doctor of science on Sir Clements Robert Markham, until recently president of the Royal Geographical Society; on Sir Thomas Hungerford Holdich, known for his explorations in India, and on Sir Thomas Fraser, professor of materia medica in the University of Edinburgh.

The Academy of Sciences of Vienna has elected as honorary member Dr. A. von Baeyer, professor of chemistry at the University of Munich; and, as corresponding members, Dr. Wilhelm Waldeyer, professor of

anatomy in the university of Berlin, Dr. Ernst Ehlers, professor of zoology in the University of Göttingen, and Professor Svante Arrhenius, director of the division of physical chemistry of the Nobel Institute of the Academy of Sciences of Stockholm.

THE British Iron and Steel Institute has awarded its Bessemer gold medal to Dr. J. Brinell, Stockholm, for his researches on the changes in the structure of steel with temperature changes.

THE Association of German Chemists has awarded its Liebig gold medal to Dr. Adolf Frank, the founder of the German potash industry.

THE Italian Scientific Society has conferred its gold medal for mathematics on Professor G. Lauricella, of Catania.

A GOLD jubilee cup has been presented to Sir Charles A. Hartley by the European Commission of the Danube, in commemoration of the fiftieth anniversary of his engagement as engineer-in-chief to the commission.

ON the occasion of the celebration of the twenty-fifth anniversary of the founding of the Russian Pirogoff Surgical Association at St. Petersburg ten foreign honorary members were elected—Drs. Senn, Roux, Lennander, Watson, Horsley, Quénu, Poncet, Rydigier, Roentgen and Trendelenburg.

MR. EDWARD ROBERTS has retired from the position of chief assistant of the British Nautical Almanac Office, and has been succeeded by Mr. P. L. H. Davis, F.R.A.S.

PROFESSOR ARTHUR FAIRBANKS, who holds the chair of Greek at the University of Michigan, has been elected director of the Boston Museum of Fine Arts.

PROFESSOR E. H. STARLING, of the University of London, has accepted the invitation to give the Herter lectures at the University and Bellevue Hospital Medical College. The lectures will commence after the Christmas recess, and their subject will be "The Fluids of the Body and their Regulation." They will deal with the production and absorption of lymph, the intake by the intestines and the output by the kidneys; with the regulation of the total amount and molecular concentration of the body fluids under varying conditions, such as bleeding, transfusion, heart-failure, dropsy, muscular exercise, high altitudes.

THE Weld Hall of Ethnology of the Peabody Academy of Science, Salem, Mass., was opened on the evening of June 26, when an address was made by Dr. Edward S. Morse, the director of the academy.

DR. PAUL GORDAN professor of mathematics at Erlangen, has retired from active service.

DR. OTTO MÜLLER has been given the title of professor at Berlin, in recognition of his work on diatoms.

PROFESSOR W. G. FARLOW represented Harvard University on the occasion of the Linnæan celebrations at Upsala and Stockholm.

PROFESSOR E. RICCIOLI, of Rome, has visited Boston and inspected the parasite work conducted by Mr. A. H. Kirkland in connection with the gypsy and brown-tail moth crusade.

AT Oberlin College, the leave of absence of Professor Maynard M. Metcalf and of Associate Professor Robert A. Budington is extended for another year, owing to the delay in the completion of the zoological laboratory.

PROFESSOR J. PERRIN SMITH, of Leland Stanford University, and Professor J. Culver Hartzell, of the University of the Pacific, will spend three or four weeks during the summer in the western and central parts of Nevada. Dr. Smith will study the stratigraphic, and Dr. Hartzell the physiographic and structural, features of the West Humboldt, the east and the Dosatoya ranges in particular.

PROFESSOR NEWTON has bequeathed to Cambridge University his natural history collections and library, together with the cabinets, cases and apparatus; also his copyrights, books, pictures, prints, drawings, letters and papers relating to natural history; also the sum of £1,000, whose annual income is to be employed in keeping up and adding to the library.

DR. THOMAS EVANS, professor of chemistry in the University of Cincinnati, dean of the

College of Engineering, died on June 28, at the age of forty-four years.

Mrs. Elizabeth Cabot Cary Agassiz died on June 27 as the result of paralytic stroke. Mrs. Agassiz was born in Boston in 1832 and in 1850 married Louis Agassiz, with whose work she was intimately associated, and whose life she wrote. Mrs. Agassiz was president of Radcliffe College until 1902.

M. U. Le Verrier, professor of metallurgy at the Paris Conservatory of Arts and Trades, has died at the age of fifty-nine years. He was the son of the eminent astronomer.

Civil service examinations will be held as follows: On July 17, for the position of aid in arboriculture, at salaries ranging from $600 to $1,000 in the Bureau of Plant Industry; assistant in grain standardization in the same bureau at salaries ranging from $1,000 to $1,200; as aid in the Coast and Geodetic Survey at a salary of $730; on July 24, for veterinary inspector in the Bureau of Animal Industry at a salary of $1,400, increasing to $1,800; for the position chemist aid in the Bureau of Chemistry, Department of Agriculture at a salary of $1,000, applications for which may be filed at any time. The length of time any chemist aid may serve in this capacity in the department is limited to two years. It is expected that within that time aids will qualify for other positions in chemistry through appropriate examinations.

The first party to take the field in connection with the cooperative investigation of the Atlantic Coastal Plain by the United States and the local geological surveys, under the direction of Mr. M. L. Fuller, of the United States Survey, is that of Mr. E. W. Berry, who has made a beginning on a detailed study of the Cretaceous flora in North Carolina. The work will include both an investigation of the river sections throughout the state by means of canoe and a thorough examination by wagon of the inter-stream areas. The expense is borne jointly by the North Carolina and national surveys. Much detailed information in regard to the lower Cretaceous floras of the state has already been obtained, and the results promise to throw considerable additional light on the Cretaceous geology of the region.

During the past winter, Mr. Robert T. Hill has completed his monograph of the geology of the Windward Islands for publication in the Proceedings of the Museum of Comparative Zoology at Harvard University. This work completes Mr. Hill's series of studies on the islands of the American Mediterranean. Mr. Hill has also completed the geological map of Trans-pecos, Texas and eastern New Mexico, which finishes the work upon which he has been so long engaged in the Texas region. He has also made for the first time preliminary reconnaissance geological maps of the Mexican states of Chihuahua, Sonora, Coahuila and Nuevoleon, and western New Mexico, Arizona and southern California. This series of reconnaisance maps, based upon Mr. Hill's long residence and study of the southwestern region, constitutes a map completely crossing the continent along the Mexican border region, and places on record the relations of the following geographic and geologic features of our country: the southern termination of the Rocky Mountain proper in New Mexico; the numerous individual mountains extending south therefrom, collectively constituting the Sierra Madre of New Mexico, Texas and northern Mexico; the outlines, boundaries and individual mountain ranges of the great Chihuahuan Desert; the southern edge of the Colorado Plateau, the area and boundaries of the great western Sierra Madre of Mexico, and the boundaries, mountain ranges and geology of the great Sonoran Desert also of Colorado, Arizona and Sonora. The geological map of Chihuahua will be published at an early date by the American Museum of Natural History in connection with a paper which Dr. E. O. Hovey has in press. The map as a whole, or parts thereof, are at the disposition of any research worker of the natural phenomenon who may wish to use the same.

*The Journal of the American Medical Association* says: "Last March many prominent physicians in America received notices to the

effect that they had been elected honorary members of the *Academia fisico-chemica Italiana,* of Palermo, Italy. Each notice was accompanied by a complimentary reference to the man's scientific achievements and the request that he would send his photograph and a copy of some of his works for the library of the academy. The notice was also accompanied by a copy of the by-laws, from which it was seen that persons elected to honorary membership were expected to pay $5 for clerical expenses of the certificate of membership, etc., and an additional sum for the engraving of the medal sent to each honorary member. The *Ztschr. f. aerzt, Fortbildung,* in a recent issue, states that similar notices have been sent to numerous prominent physicians in Europe, but that inquiry in Italy brings word that 'the so-called academy is not an institution founded for scientific purposes, but consists of more or less obscure elements who under this title devote themselves to personal and material aims.' The Berlin professor whose name figures on the prospectus of the 'academy' declares that he knows nothing at all of such an institution and that the use of his name is unwarranted. Our exchange adds that a number of physicians at home and abroad forwarded the money, etc., asked for by this 'pseudoacademy in this ingenious money-making scheme.'"

## *UNIVERSITY AND EDUCATIONAL NEWS*

THE state legislature has passed measures providing for the development of the University of Wisconsin in three important directions. It has authorized the establishment of a college of medicine prepared to give the first two years of preclinical training. An appropriation of $20,000 annually has been made for the development of the department of university extension, which includes a correspondence branch. The sum of $100,000 per annum for four years has been appropriated for the erection of a woman's building and gymnasium, and the construction of the first of a system of dormitories and commons for both men and women. In addition the legislature continued for two years more the present building fund of $200,000 per annum, which will be used to erect buildings for biology and the allied departments of pathology, physiology and bacteriology; for horse-breeding and veterinary science, and for the addition of a wing to the engineering building.

AT the recent meeting of the board of trustees of the University of Alabama the erection of the following buildings was authorized: A central heating, lighting and pumping station, an engineering building and a building for the geological museum and the schools of geology and biology. The cornerstone of the museum building was laid May 28, the address on this occasion being delivered by Governor Braxton Bragg Comer. The building is to be known as the Eugene A. Smith Hall in honor of the services rendered during many years to the university and to the state by Dr. Eugene A. Smith, professor of mineralogy and geology and the state geologist of Alabama.

THE new medical college of the University of Manila, which will be opened early in September, will pay special attention to tropical diseases. The Philippine government has appropriated $62,500 for the expenses of the first year of the institution.

GENERAL WM. J. PALMER has given the Engineering School of Colorado College, in Colorado Springs, the sum of $12,000, to be expended immediately on additional equipment in the engineering laboratories for senior work.

THE late Mr. Basil McCrea has left £75,000 to Magee College, Londonderry, for the erection of residences for the professors, the further endowment of the existing chairs, and the foundation of scholarships.

UPON the recommendation of the faculty of the college of applied science, the board of regents of the State University of Iowa has determined that the degree to be given to graduates in engineering shall hereafter be bachelor of engineering. Twenty-one graduates this year received the several degrees of bachelor of science in civil engineering, in electrical engineering, in mechanical engineering and in forest engineering.

At the commencement exercises of the university of Nebraska, June 13, degrees were conferred as follows: Bachelor of arts, 147; bachelor of science, 44; bachelor of laws, 33; master of arts, 15; electrical engineer, 1; mechanical engineer, 1; doctor of philosophy, 3. Of the bachelors of science, 17 were in electrical engineering, 10 in civil engineering, 2 in mechanical engineering, 2 in agriculture, 1 in forestry, and 12 in general science. Of those taking the master's degree 6 were in science (botany 3, chemistry 2, zoology 1), 3 in education, 3 in literature, and 3 in language. Two of the doctors of philosophy were biological students, one taking zoology as the major, with botany as the minor, while the second took botany as the major, with zoology as the minor. The third doctorate was conferred for work in ethics (major) and metaphysics (minor). Arrangements have been made for formal closing exercises at the end of the University of Nebraska Summer School on July 26, at which time degrees will be conferred upon such university students as have completed their work, whether in undergraduate or graduate courses. Fourteen students have announced themselves as candidates for degrees at this time. This arrangement makes it possible for candidates to come up for degrees in June (at the annual commencement), July (Summer School Closing Exercises), or in February (midwinter commencement).

Dr. B. H. Raymond has resigned the presidency of Wesleyan University. A chair of bible study has been established for him.

Dr. George Santayana, assistant professor of philosophy at Harvard University, has been appointed professor of philosophy.

Dr. Otto Folin, research chemist at the McLean Hospital, has been appointed associate professor of biological chemistry in the Harvard Medical School.

Dr. W. M. Munson, for more than fifteen years professor of horticulture and horticulturist of the experiment station at the University of Maine, has resigned to accept a similar position at the University of West Virginia.

Mr. L. E. Moore, instructor in theoretical and applied mechanics, University of Illinois, has been appointed assistant professor of civil engineering in the Massachusetts Institute of Technology to take the place made vacant by the resignation of Professor F. P. McKibben. Mr. Moore graduated from the University of Wisconsin in 1900 in the Department of Mechanical Engineering. He studied structural engineering at the Massachusetts Institute of Technology and has been teaching mechanics and structures since 1903 in the University of Wisconsin and the University of Illinois. He has had practical experience on the Illinois Central Railroad and also with the Phœnix Bridge Company, and other concerns.

Messrs. G. L. Hosmer, C. B. Breed, and George E. Russell have been promoted to be assistant professors in civil engineering at the Massachusetts Institute of Technology. Messrs. Hosmer and Breed are the authors of a text-book of surveying published a year ago by Messrs. Wiley.

Dr. J. Carleton Bell, Ph.D. (Harvard), instructor in experimental psychology, Wellesley College, has been appointed to take charge of the new psychological laboratory in the Brooklyn Training School for Teachers.

Miss Helen D. Cook, this year fellow in philosophy and psychology, Wellesley College, has been awarded the Alice Freeman Palmer fellowship.

Dr. Paul Clements, of Maury County, who has been serving as surgeon in the Philippines, has been elected to a professorship in the University of Manila and will sail for that place September 1.

Dr. R. K. McClung, who has been senior demonstrator in physics in McGill University for the past three years, has been appointed to the chair of physics in Mount Allison University in Sackville, New Brunswick. Dr. McClung is a graduate of McGill, and later of Cambridge, England, where he studied under Professor J. J. Thomson.

Mr. Thomas Barlow Wood, reader in agriculture at Cambridge University, has been promoted to the chair of agriculture.